Chapter 5 Past and Current Monitoring in CAN Parks and their Neighbors

The Natural Resource Challenge (NRC) represents the first service-wide effort to fund long-term monitoring. While the Inventory and Monitoring portion of the NRC is an opportunity to establish new facets of an ecological monitoring program, it is important to also examine past and current monitoring conducted by parks and their neighbors. Doing so will allow us to build upon those efforts and gain the maximum amount of understanding of park natural resources.

The areas that are now protected in Central Alaska Network parks have long histories of scientific exploration and environmental research. The history of monitoring (repeated data collection) is probably the longest at Denali, since it has been a park since 1917. As ANILCA parks, both Wrangell-St. Elias and Yukon-Charley have shorter histories of NPS supported monitoring. The focus of this section is the current and historic monitoring that is occurring by both the parks and their partners and neighbors.

This chapter is a work in progress, reflecting our initial efforts to gather and organize information about past and current monitoring activities in Central Alaska Network parks. Our "data mining" task also involves the entry of information into the Servicewide databases for existing datasets (Dataset Catalog), literature citations (NatureBIB), and species occurrence information (NPSpecies). Our "data mining" effort is still ongoing and will continue for some time. What we present here is a first, rough-cut. We include Tables 2 and 3 show monitoring efforts we are aware of but for which we did not have time to include brief descriptions for this report.

The focus of our initial search effort was monitoring conducted by the parks; we have yet to conduct a comprehensive search of efforts by other agencies. However, in our search of existing efforts by parks, we found many efforts by other agencies that are integral to natural resource management in Central Alaska Network parks, and these are included here.

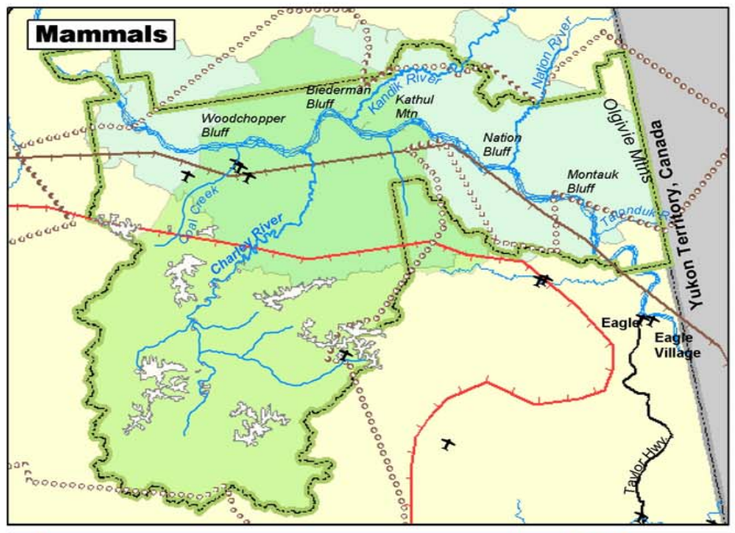
We present the monitoring efforts in the following order: physical environment (e.g., weather, air quality, snow, glaciers), aquatic (including water quality and quantity, aquatic invertebrates and fish), vegetation, birds, and mammals. We first review historic efforts, then describe current monitoring. To comprehensively show the monitoring efforts in each park, Figures 5-7 illustrates by park (Yukon-Charley, Denali, and Wrangell-St. Elias, respectively) where efforts have taken place.

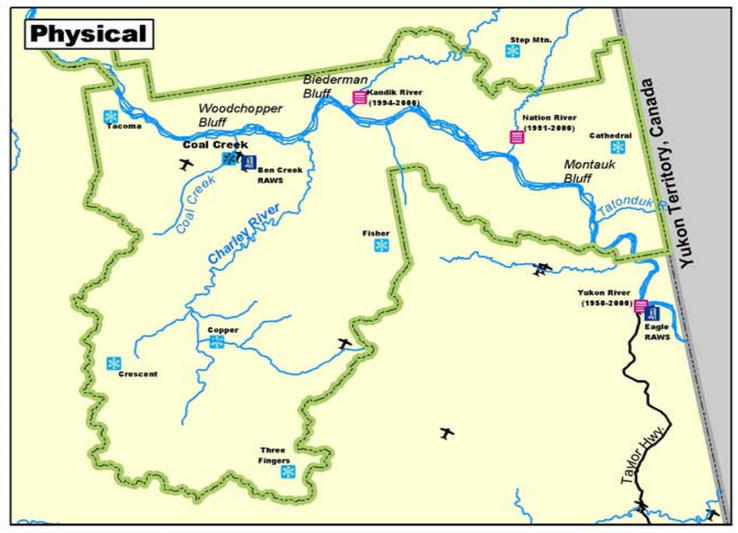
Current & Historical Monitoring Locations

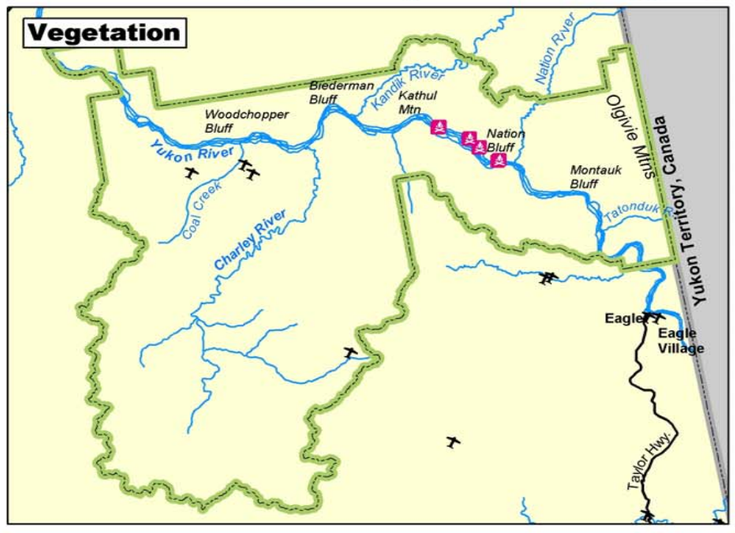
Yukon-Charley National Preserve

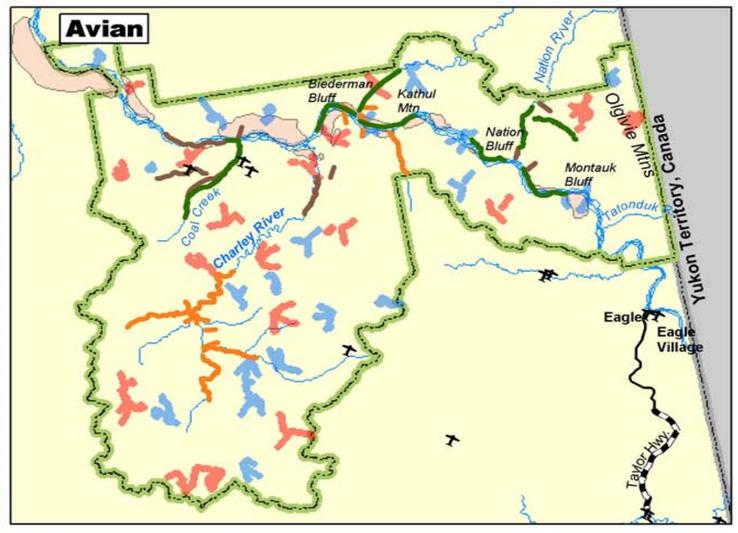
National Park Service
U.S. Department of the Interior

Figure 5
Current & Historical Monitoring Locations
Yukon-Charley NPr









Mammals
- Sheep Survey Units since 1997
- Surveyed Wolf Ranges 1994, 1997, 1999
- Historically Surveyed 40Mile Caribou Herd Summer and Calving Range
- Historically Surveyed 40Mile Caribou Herd Annual Range
- Moose Survey Area 1994
- Moose Survey Area 1997

Physical
- Remote Automatic Weather Station (RAWS)
- Historic Stream Gauges (years operated)
- Aerial Snow Markers Winter 2001 and 2002
- Coal Creek Snow Course

Vegetation
- Fire Plots 1999

Avian
- Roadside Breeding Bird Surveys (annual)
- Owl & Wintering Bird Survey 2001
- Owl & Wintering Bird Survey 2000
- Owl & Wintering Bird Survey 1999
- I&M Summer Bird Survey 2000
- I&M Summer Bird Survey 1999
- Water Fowl Survey Areas 1999

Central Alaska Network
Inventory & Monitoring

Miles
0 20 40

Scale applies to all frames

September 30, 2002

Figure 5. Current and historic monitoring for Yukon-Charley Rivers National Preserve, AK.

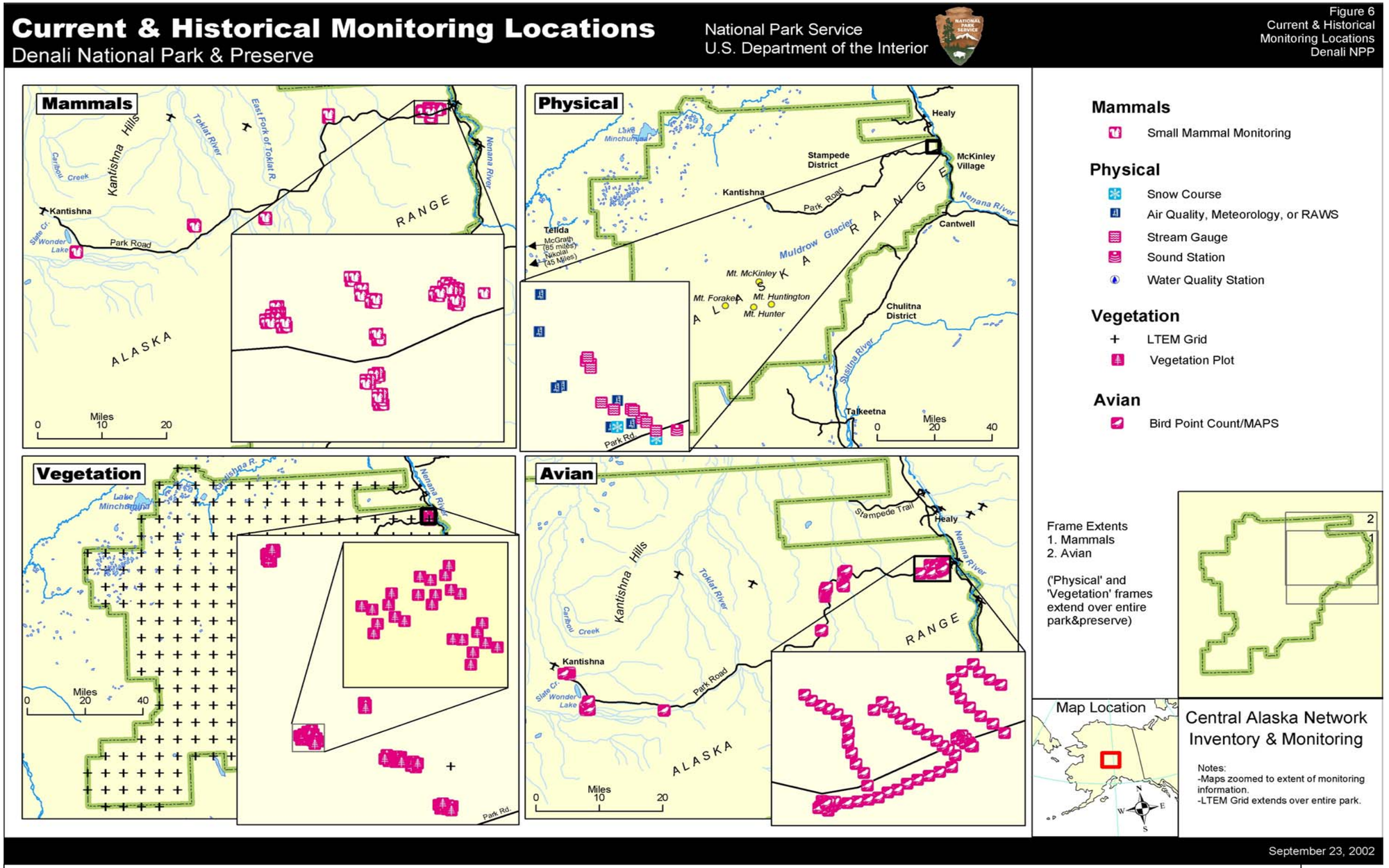
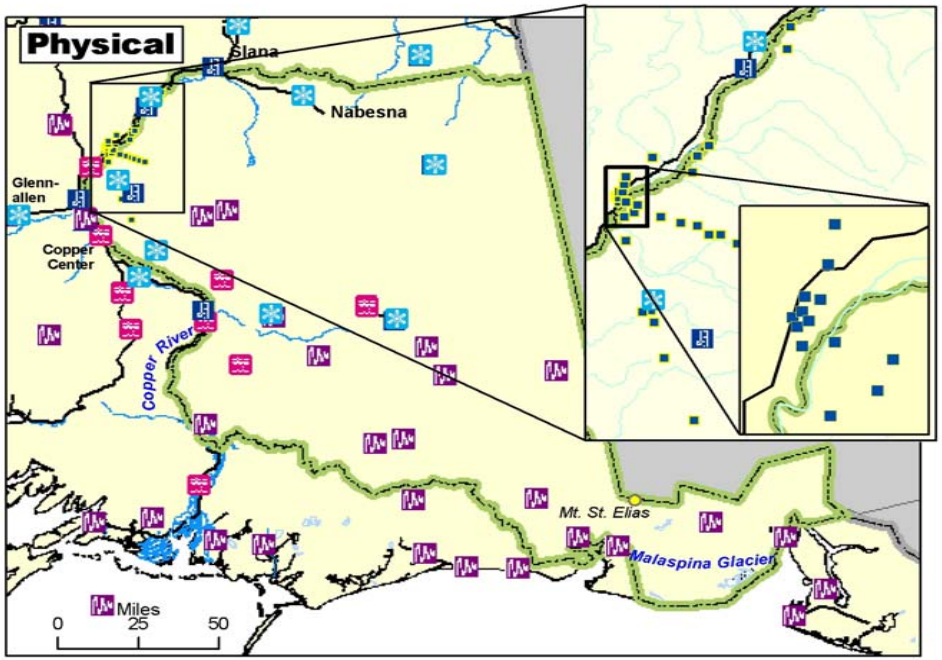
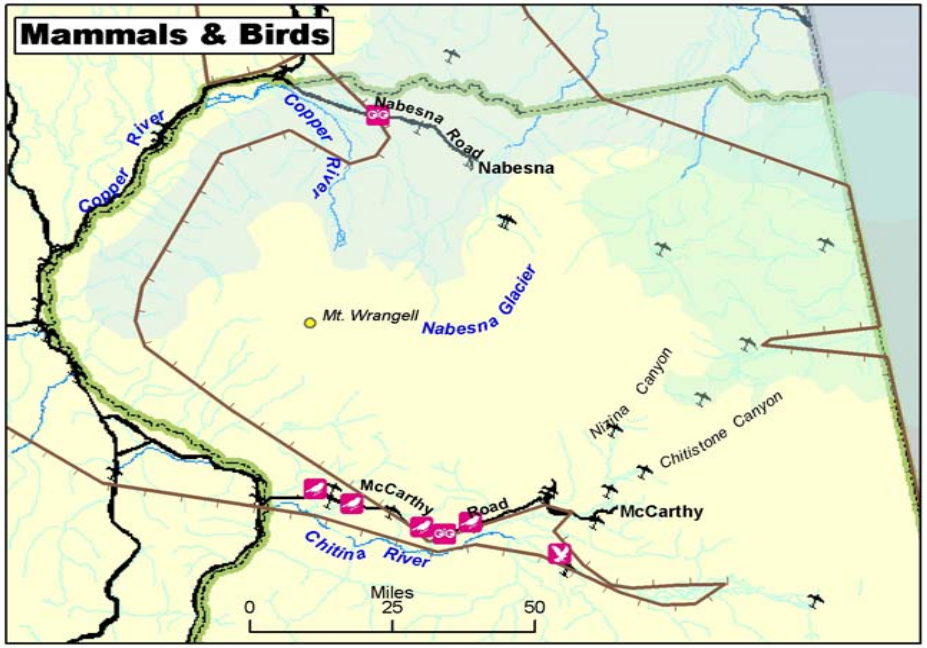


Figure 6. Current and historic monitoring at Denali National Park and Preserve.





General
- Miscellaneous Studies

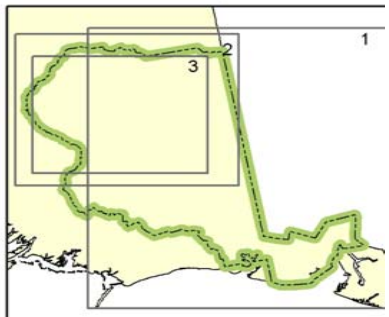
Physical
- Historic Stream Gauges
- Remote Automatic Weather Station
- Snow Course
- Seismic Station
- Air Quality Plots

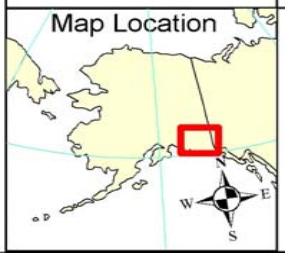
Vegetation
- SBB Historic Photo Points
- FirePro Paired Plots
- Potential Long Term Forest Inventory Plots (est. 1999)

Mammals & Birds
- Passerine Bird Point Counts 1997, 1998
- Eagle Surveys, Upper Chitna
- Bird Road Monitoring Points
- Historically Surveyed Dall Sheep Distribution
- Historically Surveyed Chisana Caribou Herd Annual Range
- Historically Surveyed Mentasta Caribou Herd Annual Range

Frame Extents
1. 'General'
2. 'Vegetation'
3. 'Mammals & Birds'

('Physical' frame extends over entire park&preserve)





Central Alaska Network
Inventory & Monitoring

Notes:
-Maps zoomed to extent of monitoring information.
-Miscellaneous Study locations in 'General' frame are approximate.

October 1, 2002

t. Elias National Park and Preserve.

Physical Environment

Features of the physical environment within Central Alaska Network parks that are monitored include weather, air quality, ultraviolet-b radiation, seasonal snow characteristics, and glaciers. Except for glacier monitoring at Denali, the parks conduct none of these efforts independently. These monitoring programs are generally conducted in partnership with others as part of national or statewide programs. The partners include the National Weather Service (weather), Alaska Fire Service (weather), Environmental Protection Agency (ultraviolet B radiation), Natural Resources Conservation Agency (snow), and the National Park Service Air Quality Division (air quality).

Weather

Weather conditions in Central Alaska Network parks are monitored in a variety of locations by two main programs: the National Weather Service and the Alaska Fire Service. These programs are aimed at providing real-time weather data for aviation, fire management, and other human activities. At Denali, a number of additional weather monitoring activities also occur.

National Weather Service - The National Weather Service operates weather stations at an array of sites in the Central Alaska Network region; only two are located actually within a park: one at Denali Park Headquarters and one at McCarthy. The nearest site to Yukon-Charley is at Eagle. A number of sites are located around the perimeter of Wrangell-St. Elias, including Yakutat, Chitina, Gulkana, Slana, Nabesna, and Northway. Sites near Denali include Healy, Nenana and Minchumina. Many of the sites have been operated continuously since 1949, but others have been operated intermittently. Data at these sites are collected daily and include temperature and precipitation. Data are available on the web at: http://www.wrcc.dri.edu/summary/climsmak.html.

The Denali Park Headquarters record is the longest climate record from a mountainous site in western North America (Juday 2000). These data are affectionately referred to as the "doggy data" because the weather station is located in the dog kennels at park headquarters. The doggy data are of great interest to many researchers and are one of the most frequently requested data sets from the park (Sousanes 2000). They can be found at the aforementioned website operated by the National Weather Service, as well as at http://fnemd-1.iab.uaf.edu/statserver/

Alaska Fire Service - The second type of weather monitoring that occurs in Central Alaska Network parks is conducted as part of the wildland fire management program of the U.S. Department of the Interior. This program, managed by the Alaska Fire Service, collects current weather, primarily during the fire season, for use in fire behavior modeling. These data are collected via Remote Automated Weather Stations, referred to as RAWS. The stations remotely transmit data every hour. The attributes measured include air temperature, average wind speed and direction, peak wind speed and direction, precipitation, relative humidity, fuel temperature and solar radiation.

There are currently a total of 19 RAWS in or near Central Alaska Network parks. In north central Yukon-Charley, stations are located just to the east of the preserve in Eagle, and at Ben Creek. These RAWS are maintained year round. Data may be intermittent during periods of low light in the winter. In and near Denali, RAWS are located 7 sites: Healy, Ruth Glacier, Talkeetna, Telida, Lake Minchumina, McKinley River and Wonder Lake. In and near Wrangell-St. Elias, RAWS are located at 10 sites: Jatahmund Lake, Kenny Lake, May Creek, Northway, Slana, Tazlina, Chisana, Chitina, Gulkana, and Chistochina. Weather data from all Alaska RAWS are immediately available on the Internet at http://fire.ak.blm.gov/scripts/wx/viewctrl.asp.

Additional Weather Monitoring at Denali - In addition to the National Weather Service and Alaska Fire Service programs, several other weather monitoring efforts occur at Denali. The Denali Long-term Ecological Monitoring Program includes the operation of 6 weather stations in the Rock Creek watershed near park headquarters. These stations were established in 1992. These weather stations are arrayed on an elevational gradient from 724 m (2,367 feet) to 1346 m (4,400 feet). The Denali Long-term Ecological Monitoring Program has recently begun coordinating with the park's Maintenance Division to record snow depths and temperatures along the park road corridor. The addition of air temperature and relative humidity sensors along the road will provide valuable information for both the practical and scientific aspects of the road corridor conditions. Weather data are also collected at the air quality monitoring site at Denali Park headquarters because weather data are needed to interpret air quality data. The latest developments in weather monitoring at Denali include the establishment of a high-altitude weather station on Mt. McKinley and the addition of weather stations with satellite telemetry capabilities at Toklat Road Camp, Stampede Mine Airstrip, and Dunkle Mine Airstrip.

Air Quality

The only air quality monitoring site in Central Alaska Network parks is located at Denali. The air quality monitoring program has been operating without interruption since 1980. It is primarily funded through the National Park Service's Air Resources Division, which manages a nationwide network of stations. The goal of air monitoring is to track the spatial and temporal trends of airborne contaminant concentrations through a nationwide array of monitoring stations. The air quality station at Denali includes monitoring instruments from various nationwide air quality monitoring networks, including:

- National Atmospheric Deposition Program (NAPD)
- Interagency Monitoring of Protected Visual Environments (IMPROV)
- National Park Service Gaseous Pollutant Monitoring Network (ozone)

Support from the Denali Long-term Ecological Monitoring program supplements the national program funding, and allows park and regional goals to be met in addition to the nationwide objectives funded by the Air Resources Division. Recently some additional air quality monitoring near Denali has been conducted in relation to the Healy Coal Mine.

In the past, air quality monitoring at Denali has been restricted to measurement of the air. Recently, there has been interest in also monitoring for air pollution effects, and the Western Region of the NPS has created the Western Airborne Contaminant Assessment Program. As part of this program, lichen samples were collected in Denali in 2002 to support the development of protocols to assess airborne contaminant accumulation and effects in lichen communities. Results of this work will guide protocol development for air pollution effects monitoring in Alaska.

Ultraviolet Radiation

As for air quality, the only monitoring site for ultraviolet-B radiation within the network is at Denali. In September 1996, the National Park Service and the U.S. Environmental Protection Agency signed an interagency agreement to cooperate on a program of long-term monitoring of environmental stressors in National Park System (NPS) units and research the effects of the stresses on ecosystems. This program is called the Park Research and Intensive Monitoring of Ecosystems Network (PRIME Net). Denali was selected as one of the PRIME Net locations, and a Brewer spectrophotometer was set up at Denali Park headquarters, adjacent to the air quality monitoring site.

A Brewer spectrophotometer measures different wavelengths of light and focuses on the ultraviolet spectra (UV-B radiation is in the 300-320 nm range of light). The instrument tracks the sun as it monitors the variation in solar irradiance throughout the day. It also records other data such as total column ozone and ambient concentration of gases. These data are then used to calculate the dose of ultraviolet radiation at the surface of the Earth. Because of the influence of sun angle, clouds, and other forms of air pollution, the seasonal variation in UV-B detected at the surface is large. Therefore, it will take many years of monitoring to detect trends in the incidence of UV-B.

Seasonal Snow Cover

Central Alaska Network parks are covered by snow for 8-9 months a year, and the timing, depth, and condition of the snow cover are important for understanding hydrological conditions and many other aspects of the regional ecosystem. As for weather, monitoring of the seasonal snow cover is accomplished in cooperation with other agencies, in this case, the U.S. Department of Agriculture's Natural Resource Conservation Agency (NRCA). NRCA establishes a variety of snow measurement systems (e.g., aerial snow markers, snow pillows) in major watersheds throughout the state to allow prediction of annual water supply.

Within Central Alaska Network parks, snow measurements have been made at Denali for many years. The 10 snow course and aerial markers located in and around Denali are visited on a monthly basis during the snow season, usually November through May. In 2002, additional snow markers and courses were added to more effectively cover variable terrain and integrate with other long term monitoring programs. Two additional snow courses were installed in the summer of 2002 at Stampede Mine Airstrip and Dunkle Mine Airstrip. These sites are co-located with new weather stations installed at the same

time. Additional aerial markers were established at sites on the south side of the range near the Eldridge Glacier, Tokosha Mountains, Upper West Fork Yentna, the confluence of the Lacuna and Yentna Glaciers, and near the Pika Glacier.

Snow measurements have not been made at Yukon-Charley until very recently. In 2001, 6 aerial markers were established at a diversity of sites that represent various elevations, slopes, aspects and terrain. Markers are read from the air with via Cessna 185 planes within 2 days prior to 1 November, 1 December, 1 January, 1 February, 1 March, 1 April and 1 May. During winter of 2001-02, a snow course was also established at Coal Creek. The course consists of 5 stations spaced every 5 m. Prior to establishment of these sites in Yukon-Charley, the only snow information for this area was from Mission Creek in Eagle. At this site, a snow pillow, snow course, and precipitation gauge are used to obtain snow density, depth and water content.

The NRCS measures snow at a number of sites in the vicinity of Wrangell-St. Elias. These include snow courses at Chistochina, Dadina Lake, Jatahmund Lake, Kenny Lake, May Creek, Mentasta Pass, Sanford River, Tazline, and Tolsona Creek.

All snow course data are compiled by major river basin and published by the NRCS. The data are available at their web site: http://www.ak.nrcs.usda.gov/

Recently, additional snow monitoring has been conducted at Denali in relation to snow machine activities in the park. The current effort is a special study but could be continued into the future, depending on management needs. In this project, the physical aspects of the snowpack that allow adequate support of snowmachine travel without causing adverse impacts to vegetation and soils are measured. In 2002. the depth and density of the snowpack in the Broad Pass area south of Cantwell, and along the Stampede Corridor were studied by visiting established sites on a bi-weekly schedule. The study began in the early season (late November-December) to determine if the areas used by snowmachiners and within the boundaries of the park had adequate snowcover for travel without disturbance to resources.

Glaciers

Currently, glacier monitoring within Central Alaska Network parks occurs only at Denali. However, glaciers in Wrangell-St. Elias have received extensive study by glaciologists. Some of these studies are long-term, but we have not yet evaluated their potential role in the network. The U.S. Geological Survey operates two long-term glacier monitoring sites in Alaska as part of its Benchmark Glacier Program. These include the Gulkana Glacier (located in the Alaska Range north of Wrangell-St. Elias and west of Denali) and the Wolverine Glacier (located on the Kenai Peninsula).

At Denali, glacier monitoring is included in the Denali Long-term Ecological Monitoring Program. Since 1991, mass balance measurements are conducted on two index glaciers (Traleika, Kahiltna) and a benchmark glacier (East Fork Toklat), maintaining one of the longer glacier monitoring records in Alaska. Measurements of mass balance and

movement are made in late May and early September, at the end of the accumulation and ablation seasons. Benchmark glacier monitoring is more intensive than index glacier monitoring, and eleven long-term measurement stakes are surveyed and assessed for mass balance trends in 2002. In addition, cooperation with the second year of a three-year project, three field surveying campaigns were completed on the Muldrow glacier to characterize "normal" glacier movement (as opposed to "surging" movement). An identified trend in the historical movement patterns of the Muldrow glacier suggests that a dramatic surge could be imminent (within a few years).

Aquatic Environment and Biota

Compilation of current monitoring of water quality, quantity and biological attributes of water bodies in Central Alaska Network parks is still underway. Monitoring of the aquatic environment relies heavily on the U.S. Geological Survey (USGS) for water quantity and water quality measurements. Currently, biological monitoring of aquatic resources is minimal.

Water Quantity and Quality

Within Yukon-Charley, the USGS maintained water flow gauging stations on the 70-mile River and Alder Creek from 1910-1912. Flume Creek was monitored in 1910 and 1913. The Kandik River was monitored from 1994-2000, the Nation River from 1991-2000 and the Yukon River at the town of Eagle from 1950-2000. There are presently water flow gauging stations on the Yukon (by Eagle), Nation and Kandik rivers, which are maintained by the USGS. Water level measurements are used to equate discharge. Current data and historical information is available on the Internet for every half-hour interval (http://www.ak.water.usgs.gov).

At Wrangell-St. Elias, USGS gauging stations have been operated in and around the park for many years, however few of them (6 of 17) have been located within the boundaries. There are currently no active gauging stations within Wrangell-St. Elias. The longest record is from 1950-1990 just outside the boundary of the park on the Copper River near the town of Chitina. Most other records are 3-6 years in length and range from the early 1900's to the late 1970's.

At Denali, water flow measurements of Rock Creek were made as part of the Denali Long-term Ecological Monitoring program, but these have been discontinued. An inventory of water quality in Denali streams was conducted in the mid-1990s. A cooperative study with USGS was initiated in 2001 at Denali to determine the occurrence and distribution of polyaromatic hydrocarbons in park aquatic environments. Semi-permeable membrane devices designed by USGS scientists at the Columbia Environmental Research Center to mimic the bioconcentration of hydrophobic organic contaminants. The devices were deployed in stream systems in Denali to collect polyaromatic hydrocarbons over an extended period of time.

In Wrangell-St. Elias, baseline limnological studies were conducted of Copper, Tanada and Prtarmigan Lakes in 1993. These lakes are sites the park has identified as being likely to be developed and the information is intended to serve as a baseline to assess rates of lake eutrophication.

Biological Monitoring of Aquatic Habitats

In 1992 macroinvertebrate sampling began in Rock Creek in Denali. The goal of the sampling was to develop a baseline data set, and establish methodologies that could be used for long-term ecological monitoring. However, data collected in 1992-1993 showed that Rock Creek supported only 3 taxa. Therefore, in 1994, 27 sites along the park road were examined for the presence of macroinvertebrate taxa. Results from this work showed that streams and rivers could clearly be divided into separate groups based upon their invertebrate fauna. Protocol development for macroinvertebrate monitoring in Denali streams has continued to the present, and recommended protocols are expected this year.

The only other biological monitoring of aquatic habitats in Central Alaska Network parks is of salmon. In Yukon-Charley, the Alaska Department of Fish and Game began conducting surveys for spawning salmon in the early 1970's, prior to the establishment of Yukon-Charley as a preserve. Summer chum salmon and fall King and coho salmon are counted from fixed-wing aircraft on the Charley, Nation, Kandik, Tatonduk, and 70-mile Rivers. The surveys are conducted at least every 3 years and are dependent on availability of money, suitable weather and qualified observers.

In Wrangell-St. Elias, Tanada Lake provides spawning and rearing habitat for two sockeye salmon. In 1991, monitoring was initiated on the lake to 1) determine if variations in water quality and zooplankton biomass correlate with variations in adult sockeye salmon escapement into the lake; 2) to determine if lake productivity is affecting juvenile sockeye survival. Two sampling stations were established in1991. Each station is sampled 6 times (once a month) beginning in late May at breakup (ice-off) through the end of October (approximate time of ice-on). Water samples at each station are taken at 1 m and 40 m. Parameters measured include; temperature and dissolved oxygen profiles to a maximum depth of 55 m, light penetration, conductivity, total dissolved solids, pH, alkalinity, hardness and secchi disk transparency. Water samples are analyzed for total solids, total dissolved solids, suspended solids, total phosphorus, total filterable phosphorus, total Kjeldahl nitrogen, total ammonia, nitrate & nitrite, reactive silicon, particulate organic carbon, total particulate phosphorus, total particulate nitrogen, chlorophyll *a* and phaeophytin.

Vegetation

At Yukon-Charley, landcover classification maps of vegetation community types were created in 1998 with 1991 Landsat TM satellite imagery (Ducks Unlimited 1998). Due to the large role that fire and succession play in the Yukon-Charley ecosystem, it is important to update landcover maps. Not only do large areas directly burn within the preserve within a ten-year period, but an even larger percent of the preserve is in early successional stages (10 – 30 year old burns) that are known to change rapidly in structure and composition. Yukon-Charley vegetation maps need to be viewed as dynamic products that need periodic updating in order to monitor landscape changes in vegetation and be useful for wildlife habitat studies. Currently, there is no program for vegetation monitoring at Yukon-Charley.

A fire effects study in the Upper Yukon area includes plots within Yukon-Charley. Fifteen randomly located permanent plots were established in September 1999 in order to examine vegetation recolonization rates and succession following fire in black spruce forest. All plots are accessible by riverboat and by foot. Study plots are arranged along 4 randomly chosen transects that are ≥ 2 miles apart. Each transect has 3 – 4 plots that are placed 200 m apart. Plots are circular with a 10 m radius. Point intercept methods are used to obtain percent cover of all vegetation species. Depth of active layer is sampled concurrently at intercept points. Photo points were established, and standing dead, downed dead and tree density and DBH were measured.

Vegetation monitoring has been an important component of the Denali Long-term Ecological Monitoring program since its inception in 1992. The approach for vegetation monitoring was modified in 2001 in response to reviewers comments received in 1997. The present objective of the program is to detect landscape-level changes in the vegetation cover of the Park that occur over decadal time scales via randomly chosen permanent plots. More intensive monitoring will continue to take place in the Rock Creek watershed, which was the original focus area of the monitoringprogram. Across elevation gradients of forest, treeline and tundra, white spruce reproduction and seed germination are measured, and permanent vegetation plots are measured every eight years. In the future it is anticipated that for a small subset of the landscape-level permanent plots process-related variables such as growth and reproduction of tree species and vegetation phenology will be examined.

At Wrangell-St. Elias, a major study of the effects of a spruce bark beetle infestation that occurred in the mid-1990s was made. Part of this study included establishment of permanent plots with the intention of revisiting them. This study also established permanent photo points at a number of sites, including along the McCarthy road.

Birds

Only one park in the network, Yukon-Charley, has conducted an intensive inventory of bird populations to assess overall presence and distribution of birds. In 1998, Yukon-Charley was selected to receive funding from the NPS Servicewide Inventory and

Monitoring Program to conduct this intensive inventory work on birds. The goals of the project were to: 1) design and implement an avian inventory plan in Yukon-Charley with methodology suitable for large parks and preserves that have minimal access and; 2) to obtain geographic data layers to characterize habitat. Specific objectives for the inventory included determining associations between bird abundance by species and habitat characteristics during the breeding season and to extrapolate the information to obtain park-wide abundance and distribution estimates. The program also sought to document owl species presence/absence by ecological subsections.

A variety of bird monitoring occurs in Central Alaska Network parks. The efforts are focused on waterfowl, raptors and passerines. Some seabird surveys have also occurred along the Wrangell-St. Elias coast.

Waterfowl - An annual count of trumpeter swans was conducted in Wrangell-St. Elias from 1984-1992. Population size, annual breeding effort and locations of brood rearing and staging areas data were collected. The U.S. Fish and Wildlife Service conducts swan surveys, generally every five years, and portions of Denali have been included in that monitoring effort.

Raptors - At Wrangell-St. Elias, surveys were initiated in 1989 and continued until 1994 to document the presence and distribution of bald eagle nest sites along the Copper and Chitina River corridors. Yukon-Charley has partnered with the U.S. Fish and Wildlife Service to monitor occurrence and productivity of peregrine falcons nesting along the Yukon and Charley Rivers since the early 1980's. Observers float the rivers annually to observe peregrines and produce an annual estimate of their productivity. Golden Eagle and gyrfalcon nesting ecology has have been monitored continuously at Denali since 1988. Work is focused in the northeast section of the park for these species. The goal of this monitoring is to examine nesting ecology of both species and measure survival and sources of mortality of birds.

Passerines - Passerine bird populations are monitored via a variety of methods by various programs. Within Central Alaska Network parks, these include the Breeding Bird Survey, off-road point counts conducted in accordance with Boreal Partners in Flight methods, and the Monitoring Avian Productivity and Survivorship program. The latter program involves use of mist nets to capture birds so they can be marked and recaptured. This allows population parameters such as productivity and survivorship to be measured. Another program that occurs in network parks is the Christmas Bird Count.

The Breeding Bird Survey is commonly called the BBS. The BBS is organized by the USGS and Canadian Wildlife Service and is a continent-wide program that deploys observers on maintained roads. BBS routes are present within Central Alaska Network parks in Denali and Wrangell-St. Elias (Yukon-Charley has no roads). BBS survey routes have been conducted along the Denali park road since 1992. Within Wrangell-St. Elias, BBS routes have been conducted along the Nabesna and McCarthy Roads since 1989. Each survey route is 24.5 miles long with stops at 0.5-mile intervals. At each stop, a 3-minute point count is conducted. During the count, every bird seen within a 0.25-mile

radius or heard is recorded. Surveys start one-half hour before local sunrise and take about 5 hours to complete.

In Alaska, where the road system is relatively limited, other methods of documenting passerine bird populations are important. The methodology for this is called the "off-road point count" and has been developed under the Partners in Flight program. Specific off-road point count methods have been developed for Alaska. Off-road point counts have been conducted in all Central Alaska Network parks,

In Wrangell-St. Elias, off-road points counts were initiated near the McCarthy road, the Nabesna road, May Creek and the settlement of Chisana in 1993. Between 8 and 20 routes are conducted annually. Routes are walked and at approximately every 200m, observers listen for all bird calls for an 8-minute period. Additionally, the distance from the observer to the bird is recorded. Off-road point counts were also conducted at Wrangell-St. Elias in 1997 and 1998 at 4 study sites within areas of spruce bark beetle infestation. These sites could be revisited in future years to track response of bird populations to response of the vegetation to the death of mature white spruce trees.

In Yukon-Charley, avian populations are estimated annually in the Coal Creek area by conducting off-road point counts. This work is initiated in 1997. As part of the aforementioned intensive inventory of Yukon-Charley bird populations ,which used a probability-based design, off-road point counts were conducted at many sites in Yukon-Charley. This inventory was designed with the idea that it could be the basis for long-term monitoring of passerine bird populations in the preserve.

In Denali, both on-road point counts (essentially BBS-type surveys) and off-road point counts have been conducted (mainly in spruce forest) in the Denali Park road corridor as part of the Denali Long-term Ecological Monitoring Program. This work continued between 1992 and 2001. In 2002 major changes in passerine monitoring were proposed in response to comments received from peer-reviewers in 1997. The revised objectives of the passerine monitoring are to describe spatial patterns of species distribution and develop indices of species relative abundance. In addition passerine monitoring would also describe and assess the spatial and temporal variability of bird assemblages and describe how passerine populations and communities respond to changes in vegetation and climate. Pilot work to assess the co-location of passerine and vegetation monitoring was undertaken in 2002 on the park-wide vegetation monitoring plots.

Mist netting of passerines under the Monitoring Avian Productivity and Survivorship Program has also occurred at Denali as part of the Denali Long Term Ecological Monitoring Program. Mist net stations have been operated in Denali since 1992. Results from Denali stations are thought to be essential for understanding population trends of passerines on a continental scale in North America. Peer reviews of the Denali program in 1996 and 1997 suggested the program needed to address several issues to best serve the needs of Denali. The peer reviewers also suggested that a thorough review of the data collected to date. The U.S. Geological Survey (USGS), Biological Resources Division, Alaska Science Center is currently spearheading an analysis of the mist net data on a

statewide scale. Results from these analyses will provide Denali and the network with guidance on if and how to continue the mist netting program.

Mammals

Mammal populations monitored in Central Alaska Network parks include small mammals, furbearers, snowshoe hares, wolves, grizzly bears, caribou, moose, Dall sheep, and mountain goats. In Wrangell-St. Elias and in Yukon-Charley, monitoring of ungulates and wolves is conducted by or in close cooperation with the Alaska Department of Fish and Game in relation to harvest management. In Denali, a long-term study of wolf-prey relationships has been conducted, continuing work started by Adolph Murie in the 1940s.

Small Mammals - Monitoring of small mammal population dynamics in the road corridor of Denali has been conducted since 1992. In 2002, the eleventh year of sampling in the Rock Creek watershed was conducted in an effort to document patterns of inter- and intra-annual variation in small mammal abundance. Other sites in Denali where small mammal populations have been monitored include the west end of the park road along the McKinley Bar trail, and at two additional locations along the park road (Teklanika River and Stony Creek).

Furbearers and snowshoe hares - In Yukon-Charley, track surveys of marten, lynx, fox and snowshoe hares were conducted beginning in 2001 using aerial videography techniques. The purpose of this effort is to develop and test the methodology, with the expectation that the method will be used in many locations in Interior Alaska to track population indices for furbearer species. Annual track counts will provide an index to population trend, as well as provide animal locations for habitat selection analyses. Random transects will be placed across the landscape and will be flown at approximately 500 ft above ground level. High-resolution digital video footage is taken from a camera port in the belly of a Cessna 185. A global positioning system (GPS) is linked into the camera system so as to assign XY coordinates to each video frame. Visibility correction factors are presently being developed for different terrain and habitat types. Footage is viewed in the office and data in entered into a database that includes track species, location, days since snowfall and various habitat parameters. Surveys will be repeated every 3 years in order to monitor changes in population size, distribution and habitat selection. This effort will be continuing in 2002 to finish development of the monitoring protocol.

In Wrangell-St. Elias, another method of evaluating snowshoe hare abundance has been used. An index of snowshoe hare abundance is determined based on hare pellet transects. Each year, hare pellets are enumerated along predetermined transects along the McCarthy and Nabesna roads, along May Creek and near the settlement of Chisana. This methodology is based on that used at the Kluane boreal forest study site in Yukon Territory, Canada.

Wolves - In Yukon-Charley, wolves are presently being monitored using radio telemetry methods. This monitoring effort is in response to a wolf sterilization program being conducted by the Alaska Department of Fish and Game in areas adjacent to the preserve. Wolves that reside in Yukon-Charley are exempt from the program and are being used as a reference population for the sterilization effort. This wolf monitoring program will continue until sterilization efforts are complete in 2003. After 2003, less expensive and labor intensive snow tracking methods may be employed every 3 years to monitor the Yukon-Charley wolf population, following methods of Becker (1991) and Becker and Gardner (1992).

At Denali, wolf monitoring has been conducted since the 1980s as part of long-term research into wolf-prey dynamics. The overall goal of this work is to monitor population characteristics of wolves and their major prey species (caribou and moose) in sufficient detail to understand the population trends of each species in the context of the interrelationships that comprise the Denali wolf/prey system. This work strives to gain understanding of the roles that winter severity, differential landscape use, and relative vulnerability of prey species play in wolf/prey relationships in Denali and, ultimately, in determining the abundance and population trends of all 3 species.

Moose - Beginning in 1994, aerial moose surveys have been conducted within the northern portion of the Yukon-Charley. This portion comprises 51 percent of the preserve and occurs from the Charley Foothills to the northern preserve border. Methods described in Gasaway et al. (1986) are followed for this survey. Surveys provide estimates of fall population size, sex and age composition and trend across years. At Wrangell-St. Elias, moose surveys are conducted in cooperation with the Alaska Department of Fish and Game and Tetlin National Wildlife Refuge. Trend counts have been determined annually since the 1950's.At Denali, moose population monitoring has been conducted as a part of the wolf-prey study.

Caribou - The Alaska Department of Fish and Game monitors the Forty-Mile Caribou herd whose range includes Yukon-Charley. Radio collars are used to locate the herd in the fall just prior to calving and just after calving. Aerial photo counts are then used to obtain overall population estimates and sex and age composition. Cow:calf, cow:yearling, and cow:bull ratios and population size trends are monitored annually, and this monitoring effort is expected to continue into the future.

In Wrangell-St. Elias, the Mentasta caribou herd is surveyed via a cooperative effort between the park, the Alaska Department of Fish and Game, and the USGS-Alaska Science Center. These surveys were initiated in the early 1970's and are conducted annually.The Chisana caribou herd survey is conducted by the park and the Alaska Department of Fish and Game. The herd has been surveyed annually since the late 1980's.

The Denali Caribou Herd has been monitored intensively as part of the wolf-prey study.

Dall Sheep - Surveys to estimate the population of Dall sheep in Wrangell-St. Elias were initiated in 1949, and have been conducted consistently since the 1960's. For these surveys the park in broken into 31 units and the population is estimated for each unit. In Yukon Charley, aerial sheep surveys are conducted every 3 years in areas available to Dall sheep within the preserve in order to monitor population trends. These areas are broken down into survey units for comparisons between years: 5580 (area along NW border of YUCH), Twin Mountain, Cirque Lakes, Charley River, Sorenson Mountain, Diamond Fork, and Copper Creek. Surveys are conducted from the end of June through the beginning of July during which ewes, lambs, yearlings and rams are counted. When available, a sightability correction factor is calculated from radio-collared sheep to obtain a population estimate. In Denali, the Dall Sheep population has been studied in various years, but no consistent monitoring effort has been conducted.

Mountain Goat - The Alaska Department of Fish and Game conducts a population survey for mountain goats annually on McColl Ridge in the upper Chitina River valley. Fixed-wing aircraft are used for this survey and an index to population size is obtained.

Information Still Being Gathered

At the time of writing of this report, there are current and historic monitoring projects of which we are aware, but still need to collect pertinent information on. The following table indicates those efforts for which documentation efforts are ongoing.

Table 2. Current and historic monitoring in Denali National Park and Preserve for which documentation efforts are ongoing.

Monitoring Project	Current	Historic
Grizzly bears	X	
Spawning salmon	X	
Dall sheep		X
Succession of the Muldrow glacier		X
North American passerine migration count		X
Merlin productivity		X
Fire Pro paired vegetation plots		X
Vegetation succession after fire		X
Tanana valley vegetation succession		X
Riparian zone vegetation structure		X
Assessment of exotic plant distribution along the park road corridor		X
Reclamation and restoration of riparian areas after mining		X
Production and availability of berries		X

Table 3. Current and historic monitoring in Wrangell-St. Elias National Park and Preserve for which documentation efforts are ongoing.

Monitoring Project	Current	Historic
Food Habits and Range Condition of Bison and Sympatric Ungulates on the Upper Chitina River		X
Alaska Shrub-tussock Community Response to Selected All-terrain Vehicle Use		X
FIREPRO Paired Plots 1982-86		X
Vegetation Trends on the Mentasta Caribou Range		X
Inventory of Vascular Flora of the Bagley Icefield		X
Element Concentrations of Baselines for Moss, Lichen, Spruce and Surface Soils in and Near Wrangell-St. Elias National Park and Preserve		X